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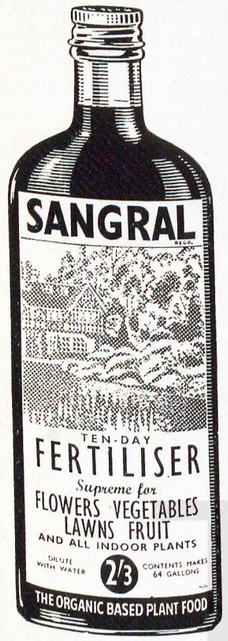

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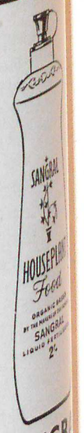

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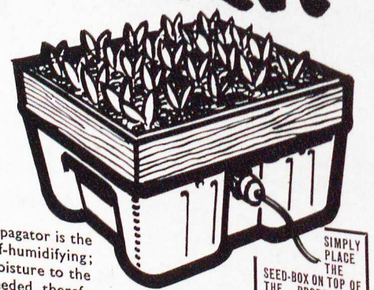

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W. B. BOYD takes a look at the latest methods of weedkilling

IF ONE READS old gardening literature the approach to weed control, when it does get mention, is usually by some mechanical means, i.e. 'Keep the hoe going' or even the 'broken dinner knives' of Kipling's day. Cultural methods such as mulching, rotation, cover or smother crops also have their place and their adherents. Some of these methods are of course very effective. For example, much can be done by using sawdust under the right conditions or planting *Hypericum calycinum* where the major planting warrants its use.

However, since the early part of this century the picture has changed and especially during the postwar years a tremendous interest has developed in the use of total and selective weedkillers. As might be expected, interest was first shown by commercial growers but gradually, owing to the lack of and high cost of skilled labour, increasing use is being made of them in public parks and private gardens.

Over 60 years ago copper sulphate was used as a selective weedkiller; this was followed by sulphuric acid and sulphate of iron in the 1920s. Tar oil, the fruit tree winter wash, was noted for its value in killing moss. T.V.O and cresylic acid could also be mentioned at this stage. None of these have lost their efficiency. Some, such as sulphate of iron, are still in use but they have been superseded by more selective and more efficient materials. The interest of the amateur in maintaining a weed-free lawn has meant a ready market for selective materials and the controlling of broad leaved weeds by chemical means was the real break through in this approach to the perennial problem of weed control.

In much the same way the development of total weedkillers can be traced. Salt was used at one time with limited effect, and arsenical materials, though dangerous, were widely used on drives and paths. Sodium chlorate had and still has many advocates for its value as a total killer and in

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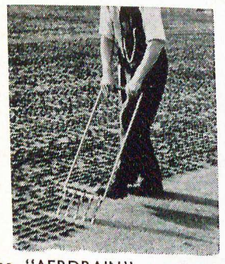

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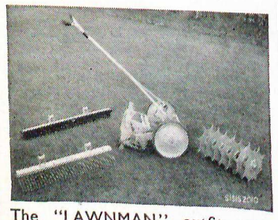

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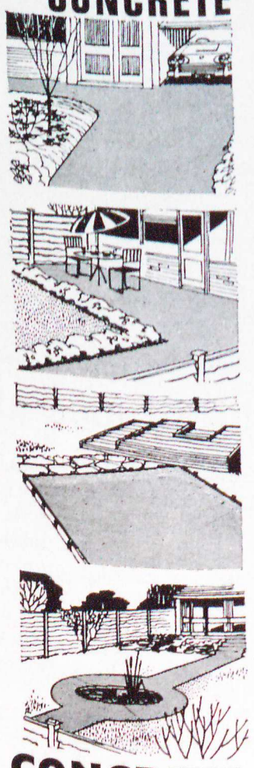

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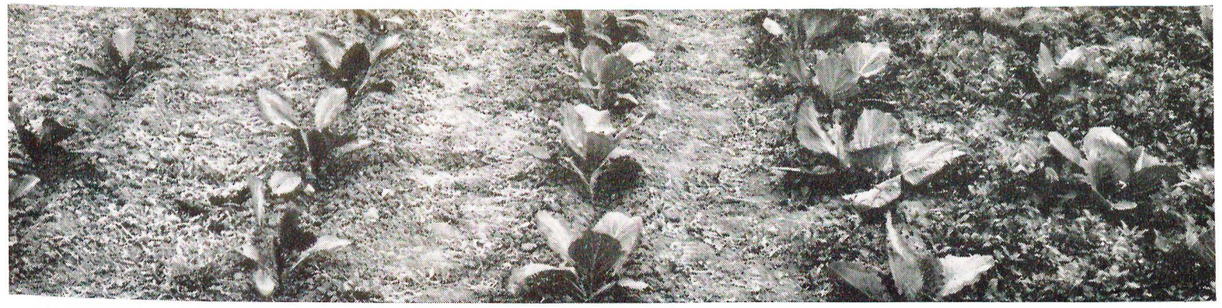
Provided rows are widely spaced, the new paraquat contact weedkiller can be used between cabbages. This weedkiller has been used on the weeds in the left of the picture but those on the right were untreated



recent years simazine has been introduced with its greater refinement and accuracy.

However, it is the present position which interests most amateurs and here undoubtedly there is a vast change since the days of sulphuric acid. It is not easy to simplify the approach to the matter nor is it easy to avoid reference to proprietary names rather than the names of the basic materials. After all, when the gardener buys it over the counter he buys it as brand 'X' or 'Y' as the case may be.

One of the easiest ways to grasp the problem is to have some understanding of the method by which the materials affect the plant. They can be grouped as follows: (*a*) those that are totally absorbed by the roots or selectively absorbed by the leaves—sodium chlorate and 2, 4-D; (*b*) contact or translocated weedkillers—paraquat and dalapon; (*c*) pre-emergence or post-emergence types—fenuron and linuron; (*d*) soil acting residual weedkillers—simazine. There is bound to be some overlapping between the groups and this will tend to increase. One material, for example, which is in theory translocated kills so quickly that it could be classed as contact. Here, I think, we should now consider them under the name of herbicides, as some users have found to their cost that the effect on crop and weed can be similar.

This grouping is not hard and fast for we could have included T.V.O under headings *a*, *b* and *c*, and it is open to criticism regarding the names used and their availability. With regard to the names, the list of approved products under the Agricultural Chemicals Approval Scheme will be found to be of real help. From the availability point of view, unfortunately, the economics of the business often make it difficult to meet the amateurs needs. However, an excellent pre-emergence contact material sold under the name of Weedol based on Grammoxone W is available and others will, no doubt, appear from time to time.

These materials need to be applied carefully, and for the inexperienced I think it is better to gain experience first with total herbicides either as a powder or liquid to pathways, then to move on to the use of selective materials on the lawn. Here again there are several effective methods which can be used and the material need not always be in liquid form. From there it is an easy matter to consider application to the shrub border, and provided we avoid contact with the plants we have two excellent proprietary materials in Weedex, based on simazine, a soil acting residual applied to a weed-free surface, and Weedol, a contact material applied to weedy ground.

Provided care is taken, these materials can be used amongst most shrubs, including roses, along hedge bottoms and around most varieties of fruit, but with Weedex there are exceptions. Some cotoneasters and ribes have, for example, been damaged. It is preferable on most soils, after application, to avoid deep cultivation but mulching with weed free material is suitable. In most instances the amount of active ingredient per acre is quite small, in the region of 2 lb per acre, for example. This means great care in accurate dilution and also in the amount of the dilute material applied to a given area. Applying by watering can with a fine rose or dribble bar is one of the best methods as more accuracy can be obtained in this way.

Herbicides have limited use in the vegetable garden. In the average garden there is too much variety of cropping in a limited space and a material specific to one crop may be harmful to another. It would appear at present that on the limited crops on which it is possible to give firm recommendations that pre-emergence is the safest with, on selected crops such as carrots, definite value in post-emergence. Simply, in pre-emergence one prepares the seed-bed in the usual way, allows weed seeds to germinate, sows the crop and just before crop emergence and at a time when there is a total weed crop, spray with a herbicide such as Weedol. With transplanted crops the same principles apply; prepare the site, allow weeds to germinate, spray, then transplant.

With post-emergence, using linuron on carrots and to a similar extent T.V.O, the stage of development of the crop is critical; it is important to apply the chemical only at the two- to three-leaf stage.

Modern herbicides are new tools in the hands of the gardener and inevitably some will be too enthusiastic; damage will be done and criticism will follow. If, however, the following points are kept in mind, damage will be kept to a minimum. Some materials are specific to certain crops; they are safe to use on one type but may damage others. They can damage other crops by drifting on them and in high temperatures by vapourizing as in those used on lawns. Some are persistent when applied to the soil and move easily in the soil water, as in sodium chlorate, and in this way may harm other crops.

Digging and cultivating after application can induce damage to the crop, particularly when simazine is applied to shrubs. Correct timing is essential as in post-emergence on carrots. On the whole the user should avoid contact with the undiluted materials and with some steps should be taken to avoid contact with animals, bees and fish. One rather too common source of damage is due to the failure to wash out thoroughly, and at once, any watering cans or sprayers which have been used for applying the material.

Modern herbicides are a new tool, bringing fresh problems, but undoubtedly a tool with a future.

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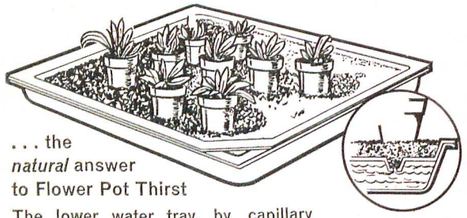

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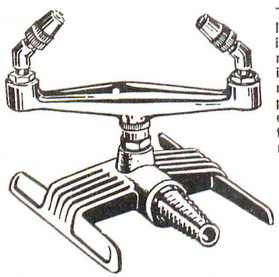

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TO BUY A SPRAYER IS EASY enough. It is only necessary to pop down to the local ironmonger, but the choice is likely to be limited and the resultant aquisition not necessarily the best for the type of garden in mind.

There are four broad types of gardens, and each type needs different equipment. The smallest garden, becoming increasing common because of the inflated price of land, usually has individual plants that can be tackled separately: there is no great area that needs spraying at the same time. One needs something that is light and easy to use and with a capacity of around half a gallon.

Cheapest of all is the bucket and syringe, about 30s., but this really is outdated and cumbersome and instead I would recommend the self-contained half gallon sprayers which are pumped while they are used. A varient of this is the double-acting constant flow syringe that is supplied from a single light-weight plastic container slung over the shoulder. These simple sprayers are ideal for small numbers of bushes, whether roses or blackcurrants and are quite satisfactory for spraying potatoes and brassicas on an allotment. The disadvantage of this type of sprayer is having to pump the syringe all the time, and this becomes tiring after a while.

Prices vary from about £3 to £4. Generally speaking top quality units have greater corrosion resistance and less propensity towards leaking. Speaking personally I do not like a sprayer—even a simple one—for which an adjustable nozzle or alternative jets are not available, since fungicides need an atomising spray and winter washes require a heavy coarse douche. The ordinary hand operated stop cock may be cheap but it is not really very satisfactory.

For the larger garden it is almost essential to use the pneumatic sprayer that can be filled with liquid and then pumped up before use. A hand pumped, one gallon model capable of operating at up to 100 pounds per sq. in. costs around £8, complete with trigger-lance and I find this the ideal all round sprayer for my garden, since normally one is not needing more than a gallon at a time. There are, however, much cheaper models available and which are quite satisfactory where very high operating pressures are not needed.

It is possible to save money by buying a pneumatic sprayer without a trigger shut-off-valve in the lance, but even in the small garden this accessory is so much more convenient and prevents wasting spray.

Nevertheless, when it comes to spraying standard fruit trees, and unfortunately it is impossible to avoid spraying these altogether, a much more expensive unit is needed if it is to be done in comfort. One can, of course, still use the syringe-type sprayer with extension lance fed from a plastic container on one's back, but this means pumping all the time at high pressure and I find it safer to use the pneumatic sprayer, pumped up before hand, and leaving one hand completely

(*Continued on page 95*)

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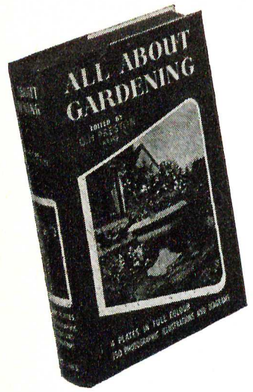

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(*Continued from page 93*)

free for climbing steps and ladders. For this work it is essential to have a sprayer which will operate at high pressure and which is corrosion-proofed against such sprays as lime sulphur.

Equally favoured by some gardeners, and widely used by commercial growers, are the continuously pumped knapsack sprayers at around £13 to £15. There is a wide variation in the maximum pressures these will operate at, some being designed for easy operation and high volume at up to 30 lb. per sq. in. and others are capable of 100 lb. per sq. in. Because one hand is used for the pumping and one for the lance, they should not be used with a ladder. Instead quite long extension lances are available so that the operator can stand on the ground when spraying top fruit. Very little physical effort is required compared with the double-acting syringe. The high volume low pressure units are well suited to spraying chemical weed-killers, for which special high volume fan jets and pressure regulators can be obtained, as well as shields for Paraquat, and spraybooms for lawn spraying in strips up to six feet wide.

It is, I think, important to realise that it is easy with a little practice to maintain an even pressure with the continuously pumped knapsack sprayer but the pneumatic sprayer will lose pressure all the time unless one is prepared to pay something like £25 for a pressure retaining sprayer. Incidentally some of the pneumatic sprayers have Schräder valve connectors which enable the car pump to be used or, alternatively, an electric compressor of the type used for paint spraying.

Having discussed sprayers at £25 one must not forget the little quarter-gallon pneumatic atomisers that are so handy for the greenhouse and indoors for house plants. A good precision made unit will cost over £2 but a simple plastic atomiser can be obtained for a little over half a guinea.

There is one point worth bearing in mind when buying any sprayer. If one can afford to buy a model which is exported abroad for commercial use, although it may cost perhaps double that of an amateur's sprayer, it can also be expected to last a lifetime in an amateur's hands.

Top picture: For the smallest garden an atomising spraying such as this half gallon model is adequate. The body is of corrosion-resistant plastic and the nozzle direction is adjustable.

Above left: Made of brass this pneumatic knapsack sprayer operates at 72 lb. per sq. in. It has a capacity of 3 gal. and weighs 21¾ lb. when empty

Above right: This simple sprayer consists of a double-acting, constant flow syringe that is supplied from a lightweight plastic container slung by a strap over the shoulder

Left: Practically the whole of this continuously-pumped, knapsack sprayer is made of plastic materials. The tank holds 4 gal. and it operates at pressures from 2 to 35 lb. per sq. in.

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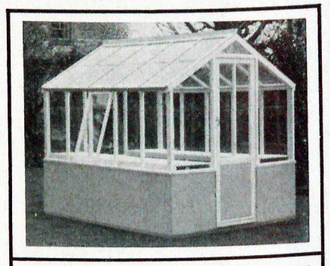

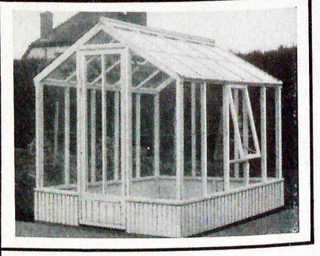

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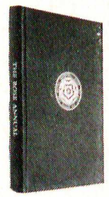

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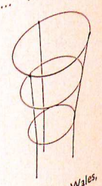

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ORGANICS—OR FROM THE BAG?

HENRY TOD, Ph.D.

A great deal has been written on the fertiliser versus organic manure controversy and, regrettably, both sides have adopted far too rigid lines of thought. This has led to a lot of confusion, with the result that the ordinary gardener is left in a state of complete puzzlement regarding the rival merits of fertilisers and organic manures. As is almost always the case, the facts lie between the two extreme views and, in cold sober fact, the whole problem works out as an economic one. The only rational course is that the two schools of thought should exist in harness together.

Any improvement in the basic growing medium—the soil—is best achieved by organic manures, that will improve the structure of the soil, coupled with *available* inorganic plant foods. The one without the other in the 20th century, can only lead to impoverished soil and ever-increasing world-wide food prices.

The hard, cold fact is that there just is not enough organic manure to go round, and the main reason for this is the disappearance of the horse as our main source of traction. With, at their peak, just about 2 million horses used in agriculture in this country alone, the amount of manure available at one time was enormous. The tractor, however, has replaced the horse almost completely in agriculture—and there is no manure produced by tractors. Where the farmer used to apply 10 to 20 tons or more of manure to the acre in the past, nowadays if he keeps stock he may be able to apply 4 tons if he is reasonably lucky.

Manure in itself is not a rich source of nutrients for our plants, and if these nutrients are to be obtained by the crop, the old, very heavy dressings must be applied. The market gardener, private gardener and farmer alike want, and expect, good yields from their crops, and big crop yields make big demands for plant

nutrients. In the absence of huge dressings of manure the deficit must be be made up somehow, or the crop yield will drop sharply, and the answer is to use fertilisers as the supplement.

But it is absolutely essential to use as much organic manure as possible, whether it be farmyard manure, compost, sewage products, spent hops, or even straw or peat. The object is to keep up the content of organic matter in the soil, not to supply nutrients but to maintain the soil structure, establish moisture control, and hold the nutrients in the soil against the leaching action of rain which tends to wash them into the drains.

As long as the soil structure is maintained, it is possible to grow crops or plants satisfactorily but at a low level of production. The old rotational methods in use up to 250 years or so ago gave crop yields such as had been obtained for the previous 500 years. These were raised three-fold in the next 100 years, mainly by changes in cultivation techniques, and now they have risen to 12 times or more the old level. Such yields are essential if food production is to keep up with demand.

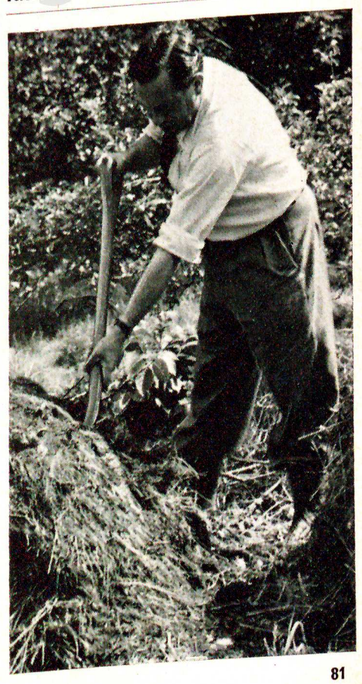
Here I must stress a point which the extreme advocates of "organic cultivation" deny, and where they are completely wrong. The plant must have nitrogen, phosphorus and potassium, and these are the same elements no matter whence they are derived. Nitrate applied as Chilean nitrate—that is sodium nitrate—is just the same as nitrate produced by the action of micro-organisms breaking down animal protein in slaughter-house waste or dried blood. It is the same nitrate that these organisms produce in the soil from ammonium sulphate fertiliser that has been applied to it.

Phosphate, whether from ground-up bone or from rock phosphate—which is itself the fossilised remains of of fish, animals and sea creatures—is still the same phosphate. This is so even when it undergoes chemical changes in the production of phosphatic fertilisers, such as from calcium phosphate in the rock to ammonium phosphate in the fertiliser.

The same applies to potassium, whether it derives from seaweed, or from mineral "potash" from the mines of Stassfurt or Alsace. Both

continued on page 83

It is only by combining the use of chemical fertilisers—above left—and rotted organic matter such as compost—below—that the problems of feeding plants adequately can be rationally worked out



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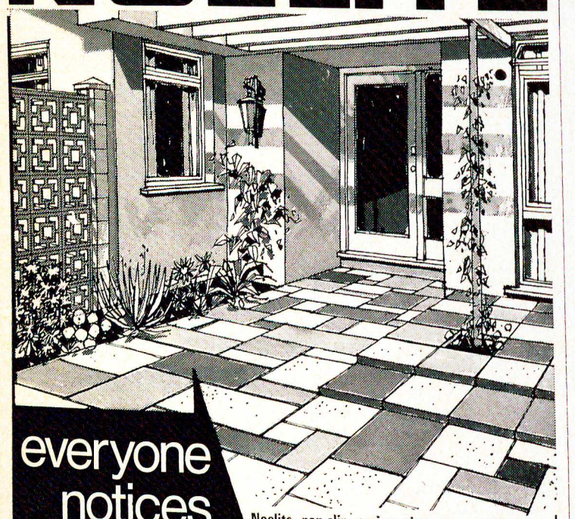

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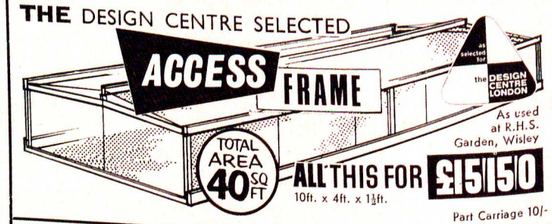

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continued from page 81

originally derived from the weathering of rock and have passed into the sea, either now or geological ages ago.

Several fields at the Rothamsted Experimental Station, where many experiments have been carried out in plant feeding, have been cropped for over a hundred years without the addition of any organic manure, only fertilisers having been applied. Some recent work there has cast doubt on the importance of organic matter in the soil, but the ordinary soil scientist would stress, and very strongly, that the farmer or gardener must maintain the organic matter level in his soil.

The farmer can do this by putting a year's grass into his crop rotation. The roots of this, and the tops when ploughed in, will boost the organic content, but this is hardly a practical proposition for the gardener. He, then, must apply organic material in the form of compost, manure, chopped or—better—composted straw, horticultural peat, spent hops or anything similar, and then bring up the levels of plant nutrients by the use of suitable fertilisers.

Rather than purchase "straight" single fertilisers it is better to use the compound, ready-mixed fertilisers which are suitable for almost all the various crops or plants that we may grow. If the average gardener had any notion just how difficult it is to produce a uniform "mix" of two, three, or four different substances and get an even distribution on the soil, he would never attempt to make up his own concoctions.

The big reputable fertiliser firms have far too much to lose to make mistakes or give unsuitable mixtures. They run extensive trials all over the country before their products are marketed, and while sometimes they will recommend heavier dressings than we, the soil scientists, would apply, we do not quarrel with their grades or the purity of their products. Any saving between "ready-made" and "home-made" fertiliser mixtures is usually marginal, especially if one takes time and safety into consideration. Making up some of these home-made mixes can be really dangerous in terms of fire and even possible explosion. The factory has its own special precautions, but have you? ●

DOES A VEGETABLE GARDEN PAY?

MARTYN T. HALL

The question of whether it pays to grow one's own vegetables is often discussed. Usually, those who are most earnest in their efforts to convince us that it does not are those who are not fond of gardening, and who are generally being prodded on by determined wives who know, much better than their husbands, how much the vegetable bill costs!

On the debit side, however, there are several factors to be considered. More work is necessary to tend a vegetable garden than a flower garden of comparable size, especially if the flower garden consists of lawns and permanent plantings. An established garden of lawns and roses, for example, is easier to maintain than a vegetable plot. With vegetables the digging, sowing, planting, growing and harvesting must be a yearly cycle.

The vegetable garden may also cost more. Not that even the best vegetable seeds are particularly expensive, but money will also be needed for insecticides, manures, fertilisers and other sundries. Some of these, it is true, may also be wanted in the flower garden, but to grow vegetables successfully demands a more fertile soil than is necessary for most flowers, and this usually entails buying manures and fertilisers in larger quantities.

On the credit side of vegetable growing, we have the money saved by not having to buy vegetables; the freshness of one's own produce, and the freedom to grow the varieties one prefers. Not only is money saved on the vegetables but larger quantities are usually consumed. As a simple illustration of this, a housewife who needs to watch the pennies will not buy two lettuce at a shilling each if she can make do with one; but she will not hesitate to cut two if they are available in the garden.

continued on page 85

Above: Intercropping makes maximum use of all available space. Here lettuce is being planted on the sides of a celery trench.
Below: Cloches make for earlier or later growth than can be achieved in the open ground

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CHEMICALS: WHERE DO WE STAND?

A. G. L. HELLYER, V.M.H.

Scientists are commonly regarded as either magicians or monsters. They are expected to provide a remedy for every ill and when they fail to do so or their remedies are only partially successful they are charged with incompetence, neglect or a complete disregard for safety.

Chemists engaged in the war against plant pests and diseases have fared no worse than the average, but they have come in for a lot of abuse. They have failed to produce any insecticide which will kill all the insects we want to get rid of and be harmless to everything else. On the whole they have been even less successful with fungicides, and Bordeaux Mixture, one of the most generally useful, was discovered by accident nearly a hundred years ago. And they have come up with several chemicals that have turned out to have unsuspected hazards and some which have had to be discarded on that account.

Yet if we are realistic we must admit that as gardeners we have a far more efficient armoury with which to keep our plants healthy and pest free than we have ever had before, and that it is being constantly extended. If the universal remedy is not yet in sight it is most probably because it can never be attained. The differences which make one organism the gardener's enemy and another his friend are often not of a nature which could not be distinguished by any chemical.

In fact, if there is cause for complaint today it is largely that there are too many remedies and too little information about their comparative value for the treatment of garden plants. Most research is carried out for agriculture or commercial horticulture. Private gardening, and particularly that section of it concerned with ornamental plants, gets little attention and must manage as best it can on the overspill from the large scale work. Many of the plants grown by gardeners are completely unknown to the research workers and that goes for some of the pests and diseases too.

So quite often the gardener must carry out his own experiments, drawing on what information he can and applying it with commonsense. It is always safer to experiment on ornamental plants rather than on food crops since the former are unlikely to be consumed and so no one is likely to be seriously harmed provided the chemicals are handled with due care. Personally, despite all assurances that they are perfectly safe if the correct time lapse is allowed between application and consumption, I still prefer not to use systemic insecticides on food crops, but I am exceedingly glad to have some of them for use in the flower garden. Menazon and dimethoate (I find them both effective) have enabled me almost to eliminate greenflies and other aphids from my garden and that, besides being a direct boon, must also limit the spread of virus diseases.

I hope that before long someone will produce a systemic fungicide that will be equally effective against rose black spot, for without it I fear many gardeners will give up the struggle to contain this widespread disease with fungicides such as captan or maneb, which must be applied weekly from April to September to be fully effective.

We also need something to control botrytis or grey mould, one of the most universal garden diseases which seems to leave virtually no plant unattacked. Dichloran will check botrytis in some of its manifestations, including the disease known as tulip fire, but I have not found it very effective against botrytis in greenhouse ornamental plants. Pelargoniums and coleus can be ruined by it in winter, especially if it is difficult to maintain temperatures over 55°F or thereabouts.

Another personal need is a really good soil insecticide to take the place of aldrin and dieldrin, now withdrawn from general use because of their dreadful persistence and consequent tendency to build up to dangerous concentrations. For a few years my garden was blissfully clear

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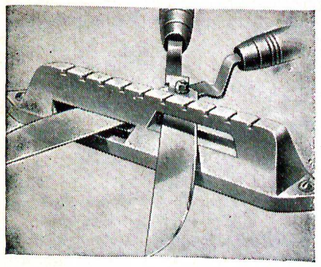

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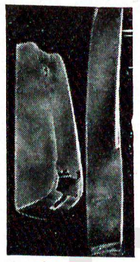

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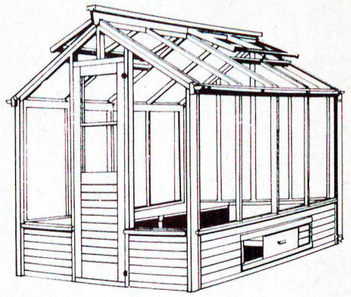

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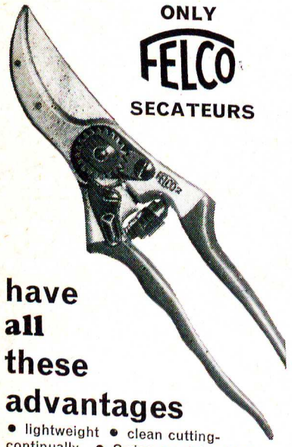

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continued from page 79

of wireworms and leatherjackets, but now these pests have returned and there is nothing that is entirely satisfactory with which to destroy them. BHC is perhaps the best available insecticide, but there is always the danger that it will impart an unpleasant musty taste to something, and even lindane, the least tainting form of BHC is not completely free of this hazard.

Derris remains one of the safest insecticides to use and it has a wide band of efficacy which even includes non-insect pests such as the red spider mites. Its drawback is a tendency to deteriorate with storage and a certain unpredictability in effect, possibly due to this. Many gardeners who are afraid of chemicals in general are quite happy to use derris since it is obtained from plants and so seems to them more "natural" than a synthetic chemical. Still, one cannot carry this idea too far, for nicotine is equally a plant extract and yet is a powerful and dangerous poison. This is greatly to be regretted for it remains one of the most effective killers of almost all sucking pests, including aphids, leaf miners and thrips and one for which they never appear to acquire any resistance as they do to some synthetic insecticides.

DDT I think must be on the way out as a garden insecticide, if only because it has had so much adverse publicity. Its persistence in the fat of animals (including birds) is a matter for concern and many gardeners now refuse to use it on that account. Trichlorphon may be the answer, but I do not think it is effective against so many pests.

Malathion, like trichlorphon, is an organophosphorus compound which can accumulate in the body. In practice as used in gardens neither chemical is likely to cause any harm if rubber gloves are worn when handling the concentrates. Still there may be occasions when medical advice is not to use any organophosphorus compounds and the very fact that they can be dangerous to human beings makes some gardeners reluctant to use them. Yet malathion is undeniably useful and is one of the few efficient, readily available insecticides that will kill most of the insects likely to be found in a garden including white fly and scale insects. Unfortunately it can damage antirrhinums, crassulas, ferns, sweet peas and zinnias.

continued on page 83

Green and blackfly (above) can be almost eliminated by using menazon or dimethoate, both systemic insecticides which can be applied by means of a watering can fitted with a fine rose (below)

One of the best fungicides for black spot of roses (below) is captan

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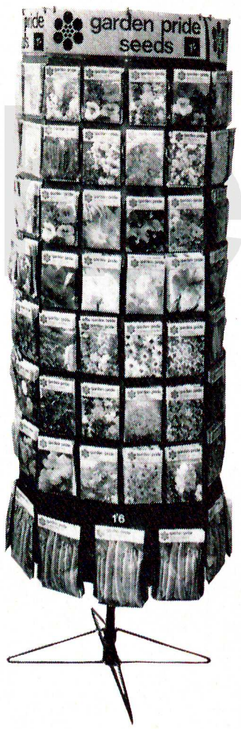

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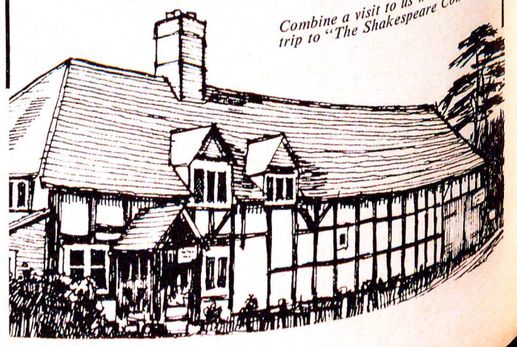


continued from page 81

No doubt the ideal way to deal with pests and diseases is to have a chemical for each kind or group as nearly as possible specific to it. This way one could pick the remedy to fit the ill and be quite certain that no harm was being done to anything else. But though this might suit the professional with his expert knowledge or ready access to specialised advice, it is of little use to the amateur, who usually finds it difficult to identify more than half a dozen pests or diseases with any degree of certainty. He wants to apply group treatment of the broadest kind, requiring no more than six chemicals at most. As time goes by it may become quite clear just what those chemicals should be, but at present everyone is likely to have his own ideas.

For what it is worth here is my own short list. Menazon plus BHC (Abol X) or dimethoate, primarily for aphids, but dimethoate also kills red spider mites, and the addition of BHC to menazon brings in capsids, thrips, leaf hoppers and some caterpillars. Both menazon and dimethoate are organophosphorus compounds and so should not be used by anyone under medical advice not to come into contact with such compounds. Both are also systemic and if they are used on food crops these should not be harvested for one week for dimethoate, three weeks for menazon. BHC is not systemic but is fairly persistent on the outside of the plant. Dimethoate may damage chrysanthemums.

Systemic chemicals, incidentally, are more or less absorbed by the plant and do not merely remain on the outside, forming a protective film or killing pests by direct contact with them. Systemic chemicals cannot therefore be washed or brushed off but most of them do undergo chemical changes within the plant which make them ineffective after a while. Some break down in this way quite quickly, others linger on for weeks or months and that is why different safety periods are laid down for different chemicals. A safety period is the time that must elapse between the last application of the chemical and the use as food of the plant to which it was applied.

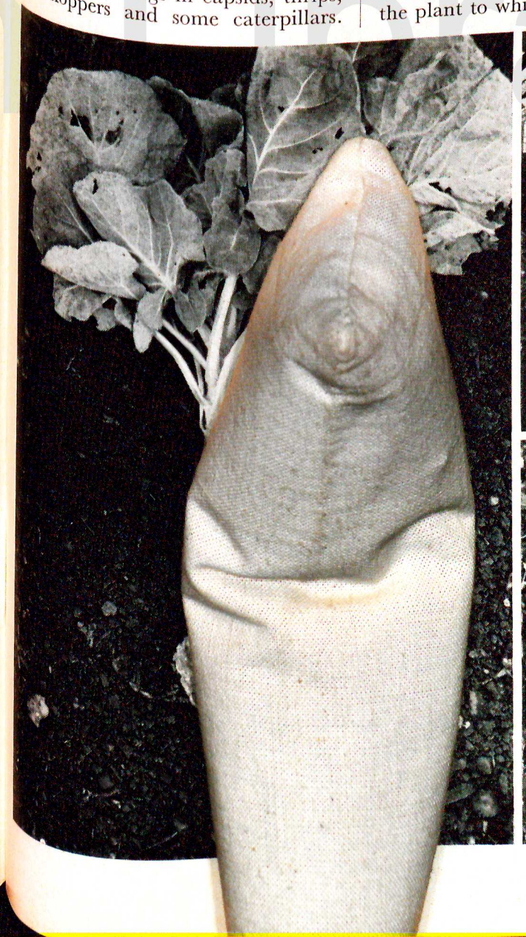
DDT plus BHC smoke generators are for use in greenhouses to kill white fly, aphids, capsid bugs etc. If used on food crops two weeks must elapse before they are used.

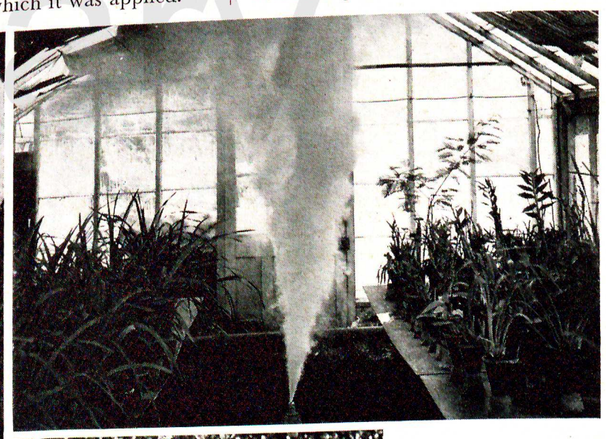
Malathion deals with a wide range of pests on food crops. Only one day need elapse between application and harvesting. I would prefer to allow one week. A mixture of malathion and trichlorphon would probably be even better, but it is not available commercially, though it could be prepared in the garden.

Calomel dust is used for brassicas, as a protection against club root disease and cabbage root fly. It is also useful for controlling lawn diseases.

Captan controls rose black spot and apple and pear scab. Bordeaux Mixture or thiram are general fungicides. Quintozene (Botrilex) is used as a dust for all bulbs, corms and tubers before they are planted to kill fungus spores on them and to give protection from soilborne diseases.

But already I have a list exceeding my maximum of six, without even mentioning a weed killer.





To prevent club root disease of brassicas (far left) the roots should be dipped in calomel paste before planting. DDT and BHC smoke generators destroy many greenhouse pests (above), and outdoors a modern lightweight pressure sprayer (left) is very useful

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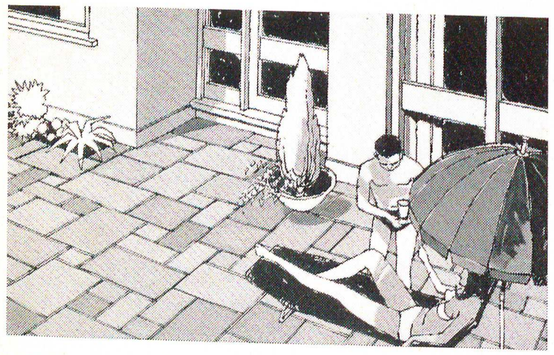

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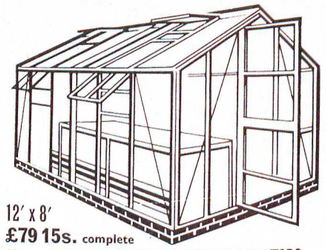

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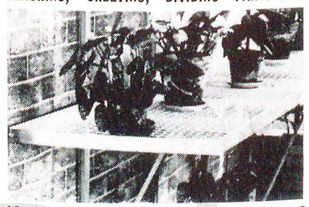

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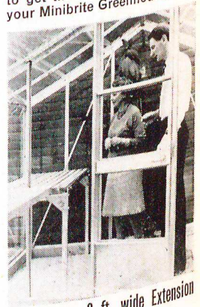

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IS SOIL STERILISATION WORTHWHILE?

J. K. FERGUSON, N.D.A.

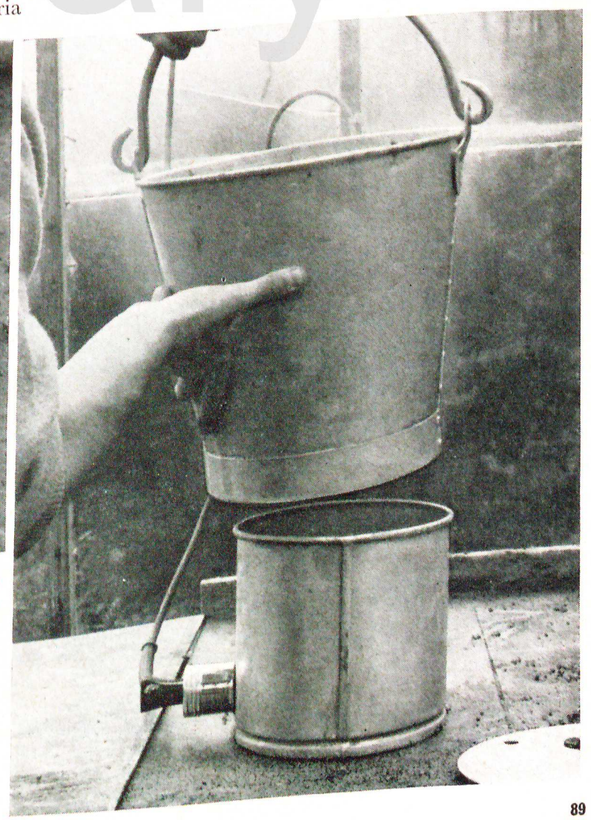
Although it is possible to advance arguments that soil sterilisation is an inconvenient and probably an uneconomic practice for the amateur gardener, it is impossible to dispute in academic or theoretical terms the advantages which it brings about.

Soil, although by mass a largely inert material, derives much of its character from the living material it contains. To attempt to compile a complete list of all living matter found in soil would take a complete volume and to a large extent would not greatly aid the practical gardener. It is sufficient to say that a number of the creatures and plants are beneficial and others very detrimental. The life forms themselves range from the lowest forms of plant and animal life up to earthworms, insects and high forms of plant life such as make up the normal weed population in a garden. Comparatively little can be done normally to build up useful soil inhabitants such as the many strains of bacteria which play utterly essential roles in plant growth and, normally, much more to the point is what can be done to discourage the multitude of harmful creatures and plants which inhabit every garden soil.

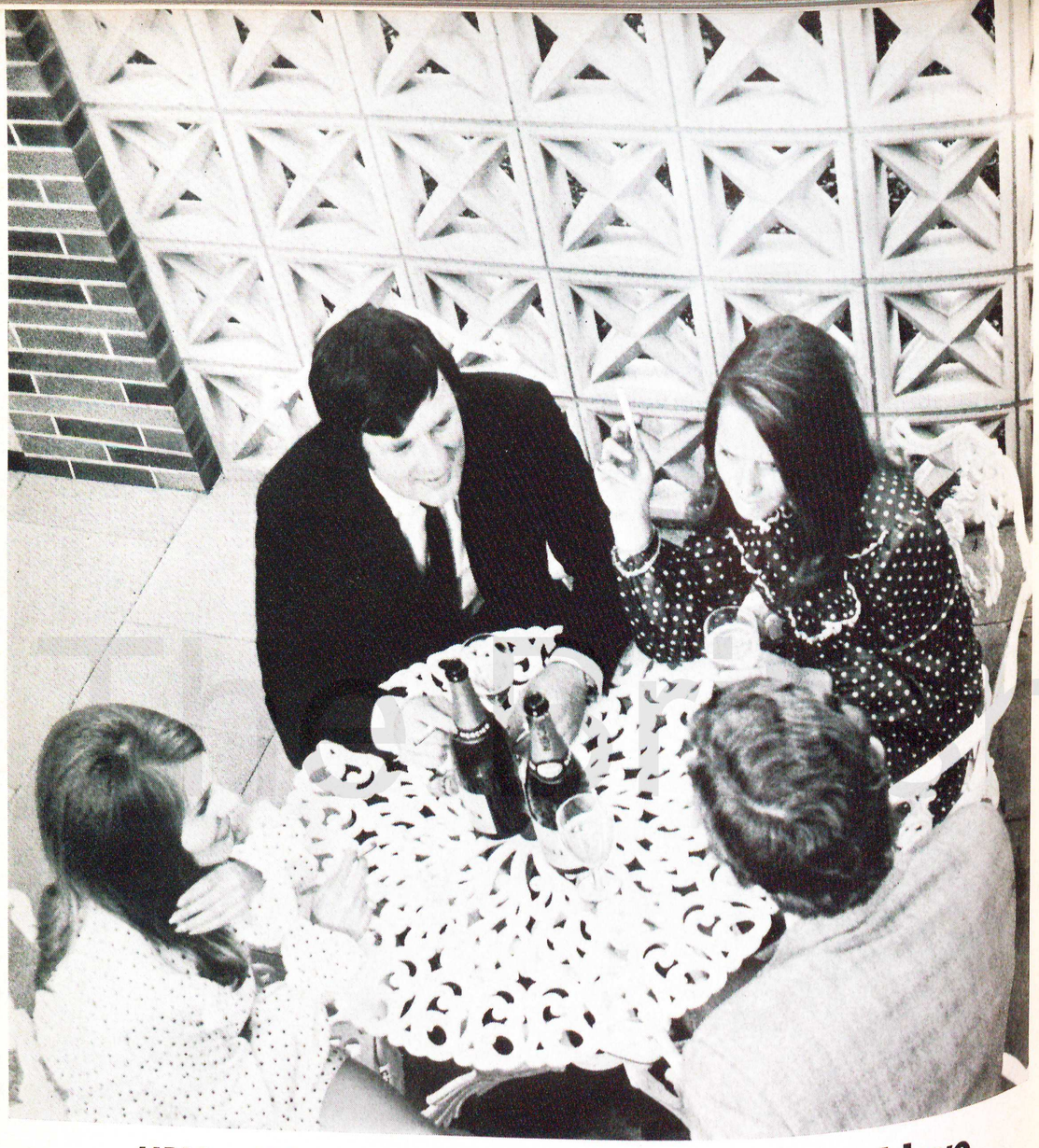
The whole point of sterilisation is to kill off as many of these menaces as possible including disease organisms, moulds, weed seeds, weed roots and insect life in egg, larval or cocooned form; anything and everything, in fact, which is likely to prove detrimental to growing plants. This is done without harming the beneficial organisms unduly and so the soil is only partially sterilised.

The use of heat is the oldest method of sterilising soil and there are records of "burning fields to make them whole" in Roman literature. Such methods were used until fairly recently and, in fact, still are in some places. A layer of combustible material is placed on the surface of the

continued on page 91



The most satisfactory way of sterilising soil is by steam and half proprietary sterilisers can be purchased. Water is heated in the base (above) and an electrical element heats to generate steam. A bucket — perforated in the base and which is the soil container — is placed on the base (right) so the hot steam gradually percolates through the soil



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continued from page 89

ground and it is set alight. The longer it can be made to burn the greater will be the degree of sterilisation and the deeper the penetration. This straightforward burning, flaming with a flame gun or the variation of steaming are all recognised methods and are all effective when carried out efficiently.

In addition to these traditional methods much has been done in the last few years to find new chemicals for sterilisation. Original materials used for this job were formalin and cresylic acid but now there are derivitives of these and other substances sold under a variety of trade names. These are available in both liquid or powder form. At one time or another everyday materials such as soot and salt have been recommended but the effect of these are purely local and of little real effect. As with methods using heat, chemical sterilisation can do a very efficient job but must be carefully handled.

Some of these methods, however, such as burning, can have a detrimental effect on soil structure, destroying the texture of a good soil and making it very fine and easily blown away in the wind. Many of these materials are dangerous to humans and animals and manufacturers' instructions must be followed strictly.

Steaming is the most widely practised method among professional gardeners. It is exceedingly effective if carried out properly and consists of injecting jets of steam into the soil and covering the area with some type of material to prevent the steam escaping. This allows the temperature of the soil to be raised to 180°F. to 200°F. as quickly as possible and harmful organisms are destroyed effectively.

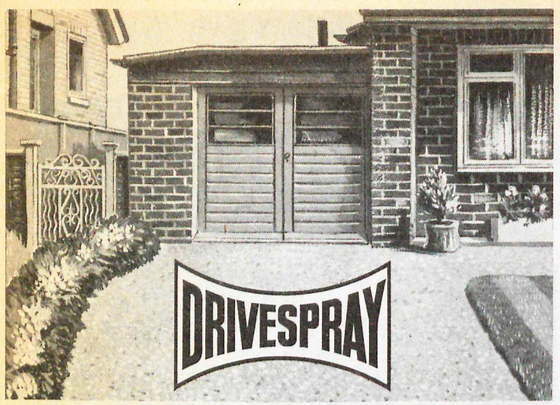
Sterilising outside soil is not really worthwhile. I know it can be done but it is difficult, expensive and time consuming and its effects are not all that long lasting. The only exception I would make is when a piece of ground is so badly affected with a disease organism or insect pest that it is totally useless unless some form of soil sterilisation is carried out.

Steaming soil borders is not practical in an amateur's greenhouse but a crop such as tomatoes cannot be grown in the same soil, year in, year out, without harmful organisms building up, resulting in a gradual decline in the amount of tomatoes produced. When it is possible, the best thing to do with the borders of a greenhouse is to change the soil every year but this is a major task and many gardeners do not have the time or facilities.

The most convenient method in small greenhouses is to use chemicals but time must be allowed for them to do their work. Plants cannot occupy the house at this time and, as most gardeners use their greenhouses all the year round, this could raise problems.

What then is the answer? Small quantities of soil for a seed or potting compost can be sterilised with a small sterliser—there are electric models and others where a fire is made to heat water to produce steam. Soil borders can be treated with chemicals such as formalin or dazomet, but the system of cultivation could also be changed. Tomatoes, for instance, could be grown by the ring culture system. Instead of the plants being grown in a soil border they are set in bottomless pots which are stood on a bed of weathered ashes or aggregate isolated from the soil below with polythene sheeting.

Formalin is one of the chemicals used for destroying harmful organisms in soil. A heap of soil (above) is being watered with the diluted chemical and it is then covered with sacking (below) to allow the fumes to penetrate to all parts of the soil



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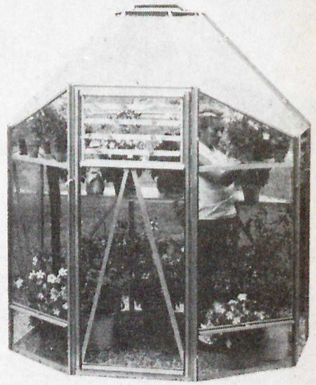

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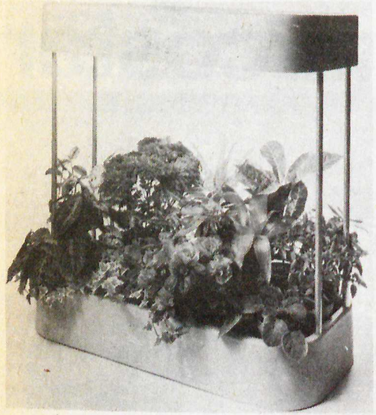

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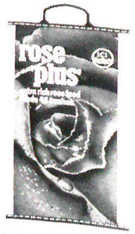

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BY JOHN FORSYTH

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THE PUBLICATION of Rachel Carson's book 'Silent Spring' in 1963 did much to focus attention on the dangers which could arise from the use of insecticides and other chemicals in the garden and on the farm.

Although there were many critics of the late Miss Carson's style—she had a tendency to blurr the distinction between fact and inference when she thought it would lend weight to her case—there can be no disagreement with her main argument. If insecticides and other chemicals must be used in the garden, then they should be used to give effective control against the pest concerned and have a minimum of side effects on other insects, animals and plants.

Nowadays there are approximately 30 different insecticides available to the amateur gardener. These are presented in over 220 formulations, each designed and sold for specific purposes under a variety of trade names.

There is no point in cataloguing their names and uses as this has already been done in the Royal Horticultural Society's publication 'Gardening Chemicals', and I will confine my attention to recent changes in the availability of insecticides to the amateur gardener.

Insecticides vary a great deal in their active life after application to the plant or soil. Some, such as malathion, have such a short active life that treated vegetables can be used one day after the last spray or dust application. Others, such as the organochlorine compounds, require several weeks between last application and harvest, e.g. DDT—two weeks.

Two other organochlorine compounds must be mentioned here—aldrin and dieldrin. Both are excellent insecticides. Aldrin is effective against soil pests such as cabbage root fly, carrot fly, leatherjackets, wireworms and narcissus fly. Dieldrin is also effective against cabbage root fly, carrot fly, wireworms and large narcissus fly.

However, these chemicals, efficient as insecticides, are no longer available for general use. It has been demonstrated that these are very persistent insecticides, and gradually build up as deposits in the body fat of animals, including man. Although no actual damage to human beings has been demonstrated, the committee appointed by the Government to investigate this problem found sufficient evidence to show that these chemicals were having an effect on the level of fertility of certain birds. This led them to advise the Government to limit the use of these chemicals, especially where alternative chemicals are available.

The evidence against DDT was insufficient for any immediate decision to be made about its use and no evidence was available to cause any limitation to be made on BHC.

The following are the quoted recommendations of the Cook Committee which have been adopted by the Government, and which affect the amateur gardener: 'No restrictions should be placed on the current use of BHC (including gamma-BHC) in agriculture, horticulture, home gardens and food storage practice; no restrictions should be placed on the current use of DDT in agriculture, horticulture, home gardens and food storage practice, but its use should be reviewed at the end of three years' (i.e. February 1967).

After recommending that aldrin and dieldrin can be used in commercial agriculture and commercial horticulture against specified soil pests, the committee's recommendation continues: 'All other current uses of aldrin, dieldrin and heptachlor in agriculture, horticulture, home gardens and food storage practice should cease as soon as this can be arranged.'

In another part of their report the committee say: 'We hope that efforts will be made to find equally effective, but less persistent, pesticides to replace the more persistent DDT.'

Thus we have now to find alternatives suitable for the control of pests previously controlled by aldrin and dieldrin, and preferably, by DDT as well. The following chemicals are available:

1. Malathion, an organo-phosphorus compound of comparatively low mammalian toxicity and short persistence.
2. Derris, based on rotenone compounds of plant origin, which has rather short persistence.
3. Pyrethrum, also of plant origin, gives a good 'knock-down' of pests, and is usually combined with another insecticide for increased effectiveness.
4. Formothion, a systemic organo-phosphorus compound.
5. Trichlorphon, an organo-phosphorus compound of short persistence.
6. BHC, which is a persistent organochlorine compound and should therefore be used as little as possible.

In the list of chemicals that can be used with the minimum of risk that appears on page 76, it will be noted that DDT is recommended for the control of web-spinning, winter moth and tortrix caterpillars, cutworms, fungus flies, blackcurrant, pear, and violet midges, rhododendron whitefly and rose sawfly. Trichlorphon is less persistent and is likely to replace DDT for these pests.

Unfortunately DDT is often presented in combination with the other insecticides listed as alternatives. This is understandable as it is a very useful insecticide which kills many leaf-eating insects such as beetles, blossom weevils and caterpillars, also leatherjackets, thrips and wasps. When formulated with, for example, malathion, this gives the user a potential for the control of most pests which are liable to trouble his plants and crops during the growing season.

However, there are formulations of the individual insecticides available to the amateur gardener, and these are listed against the pests on page 76.

Cabbage root fly can be controlled by dressing the seed with a BHC seed dressing (although dieldrin was more efficient). Carrot fly presents a more serious problem, as BHC applied to the growing root would cause taint. Its use must be restricted to a gamma-BHC (lindane) seed dressing. This will give protection against the first generation of fly. If the second and third generation attacks are heavy, then serious damage usually follows.

The chemical diazinon (an organo-phosphorus compound) is effective against both of these pests. It has been approved for use by commercial growers. For cabbage root fly it is applied as a drench, and for carrot fly it is applied in a granular form which is drilled *under* the line where the carrot seed is sown. It is effective throughout the growing season of the carrot. It is to be hoped that diazinon will soon be available to the amateur gardener.

The Ministry of Agriculture have an Agricultural Chemicals Approval Organization. This body assesses the suitability of insecticides for use in agriculture and horticulture which are submitted by manufacturers. The approval scheme is voluntary and the approval sign shows that the chemical is considered suitable for the uses described on the label. The label itself has been carefully worded to give all the necessary information for the safe application of the chemical.

Formulations which have been approved carry a distinctive 'A' surmounted by a crown. Of the 228 insecticide formulations available in the United Kingdom in 1965, 78

continued overleaf

INSECTICIDES FOR THE AMATEUR GARDENER

had Ministry of Agriculture approval.

'Chemicals for the Gardener' gives details of these insecticides and pests against which they can be used. It also gives details of fungicides and weed-killers which have been approved for use in the garden.

The accompanying list of pests under their common names gives chemicals which can be used with a minimum of risk. Some of them are alternatives of aldrin, dieldrin and DDT. It must be made clear that DDT *may* still be used, and may give a more efficient control of a pest. However, the user of an alternative chemical will have the satisfaction of knowing that he is not adding to the DDT in the soil which will probably end up in the body fat of some human being in the not too distant future

Insect Pests	Chemical Control
Ants	BHC, trichlorphon
Aphids (greenfly and blackfly)	malathion, derris formothion (roses only) BHC, dimethoate malathion derris lime sulphur
Apple sucker	malathion
Asparagus beetle	derris, malathion
Big bud mite	hot water treatment
Blackfly, *see* Aphids	BHC, calomel (gives limited c
Brown scale	BHC, malathion
Bryobia mite	gamma BHC seed dressings
Bulb scale mite	trichlorphon
Cabbage root fly	DDT, trichlorphon
Capsids	malathion
Carrot fly	derris, malathion, trichlorphon
Caterpillars: winter moth and tortrix	DDT, trichlorphon
Codling moth and tortrix	BHC
Various caterpillars	hot water treatment
Web-spinning caterpillars	BHC
Chrysanthemum leaf miner	DDT, trichlorphon
Chrysanthemum eelworm	derris, mowrah meal
Cockchafer grubs	BHC, trichlorphon
Cutworms	specialist advice required
Earthworms	BHC, derris
Earwigs	DDT
Eelworm	derris, malathion, polybutene
Fleabeetles	lime sulphur
Fungus flies	BHC
Fruit tree red spider mite	derris, malathion
Gall mites	derris, malathion
Gladiolus thrips	
Gooseberry red spider mite	BHC, trichlorphon
Gooseberry sawfly	malathion, pyrethrum and der
Greenfly, *see* Aphids	(aerosol), formothion (roses o
Holly leaf miner	BHC, malathion, pyrethrum
Leafhoppers	BHC
	BHC
Leafminers	malathion
Leatherjackets	DDT, malathion/DDT
Lilac leaf miner	BHC
Mealy bugs	BHC, malathion
Midges: blackcurrant, pear, violet	BHC
Millipedes	BHC, calomel (gives limited
Mushroom flies	BHC
Narcissus bulb fly	lime sulphur
Onion fly	derris, malathion
Pea and bean weevil	derris, malathion, pyrethrum
Pear leaf blister mite	derris, also azobenzene smo
Raspberry beetle	DDT, DDT/malathion
Red spider mite	malathion, formothion
Rhododendron whitefly	BHC
Rose leafhopper	derris
Sawflies:	derris, malathion, trichlorph
apple	BHC
blackcurrant	DDT, trichlorphon
gooseberry	malathion
plum	metaldehyde
rose	dressing of BHC with capt
other ornamental plants	thiram
Slugs and snails	BHC
Seed pests	BHC
	BHC, derris, malathion,
Springtails	pyrethrum/derris
Symphilids	BHC
Thrips	derris, BHC, malathion
	malathion, pyrethrum/derris
Vine weevil	BHC
Wasps	BHC
Whitefly	malathion, BHC
Wireworms	
Woodlice	
Woolly aphid	

Perennials for SANDY SOIL

BY CHRISTINE KELWAY

I AM A GREAT BELIEVER in suiting the plant to the soil rather than the other way about. Of course, if yours is a thin, hungry sand and you have a passion for herbaceous paeonies or moisture-loving phloxes, nothing will deter you from 'having a go', though by and large the best gardens are those where plants grow happily without undue cosseting. Since there are many which enjoy a well-drained sand, it seems a pity not to use them.

A garden on sandy soil is the lazy man's dream. He can work it with the least physical effort and can spread his labour over months of the year when heavier ground is better left alone. Yet it has grave disadvantages, the lack of plant food and its inability to retain moisture. A bucketful of water emptied on to sand vanishes immediately and rain evaporates on the ground as it lands. One has not to wait for a scorching hot summer to discover those plants which flag after a few rainless days, and if you plant the wrong ones they never achieve the height or beauty you admire so much in a friend's garden on good rich loam.

Under hard conditions of lack of nutrients and moisture, plants make relatively little green growth and tend to concentrate on producing more flowers which have stronger colours and more scent. A plant on a fat, moist soil will produce larger flowers, paler in colour with less scent, though the flowers last longer than those on a sandy soil, which are out quickly and over sooner.

Since my own soil is one of the most difficult there is, an alkaline sand which at the start consisted of almost pure sea sand blown by the wind from a nearby beach, I have been forced to make a special study of plants for these conditions. Over the years, additions of strawy farmyard 'muck' and annual mulches of rotted compost have darkened the top spit, but fresh ground brought into cultivation reveals the basic yellow sand.

Though the sea sand of shore gardens differs from the acid sand of inland districts in having a high lime content, this is not the deterrent to perennial plants that it is to many shrubs. Indeed, most herbaceous plants do not resent lime. Lupins, it is true, which grow like weeds on the acid sand of Surrey, are not fond of lime, though aubrieta and the whole dianthus family fairly revel in it.

Plants with long tap roots are particularly adapted to light sand soils. Echinops and eryngium send down long tap roots in search of moisture, and their unusual blue, ball-shaped or teazle flowers are a striking addition to the late summer garden. *Catananche caerulea* has a long tap root, which makes it difficult to transplant, but it is very prolific on poor soil with its lavender-blue cornflower-type flowers. Others have succulent leaves which are store-houses of water during drought. *Sedum spectabile* and its hybrids, Autumn Joy and the dwarfer Ruby Glow, are splendid perennials for dry soils, with glaucous leaves that are decorative ornaments to any garden long before the flat flower-heads colour up in pink and red during August.

Bergenias are certainly not herbaceous, for the broad glossy leaves persist all winter, green, purple or red, and anticipate the spring with pink or red flowers on stout stalks in February. They are happy in any soil though they prefer some shade. *B. crassi-*

Top picture: Stokesia laevis *Blue Star, a low growing plant with large, lavender-blue flowers*
Right: The pink Erigeron Foerster's Liebling has a long season and is another plant that prefers light soil

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